

Application No.: 10/754,797
Response to Office Action of November 24, 2004
Attorney Docket: WETCO-001A

REMARKS

The foregoing amendment and remarks which follow are responsive to the non-final Office Action mailed November 24, 2004 in relation to the above-identified patent application. In that Office Action, Claims 14-26, 28, 30 and 32 were withdrawn from consideration as being drawn to a non-elected invention. With respect to remaining Claims 1-13, 27, 29 and 31, drawn to a method for controlling scale formation, Claims 1-10, 13, 27, 29 and 31 were rejected under 35 U.S.C. 103(a) as being unpatentable over Boyce (i.e., United States Patent Number 6,402,957) in view of Takahashi (i.e., United States Patent Number 5,403,521). Claims 11 and 12 were rejected under 35 U.S.C. 103(a) as being unpatentable over Boyce in view of Takahashi and further in view of Oldsberg, et al. (i.e., United States Patent Number 6,468,470). Still further, Claims 1-13, 27, 29 and 31 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-13 and 15-31 of Applicant's co-pending application Serial Number 10/754,797.

By this amendment, Applicant has cancelled Claims 14-26, 28, 30 and 32 as being drawn to a non-elected invention. Applicant likewise confirms the election to prosecute Claims 1-13, 27, 29 and 31. Applicants have further submitted herewith a Terminal Disclaimer pursuant to 37 C.F.R. 1.321(c) to overcome the obviousness-type double patenting rejection maintained with respect to co-pending patent application serial Number 10/754,797. Accordingly, such issues are believed to have been addressed.

With respect to the substantive rejection of the claims in view of the prior art, Applicants, by this amendment, have more clearly defined the subject matter which they regard as the invention, as well as have differentiated the present invention from the cited prior art. In this respect, none of the references neither alone or in combination, teach or suggest a method for controlling silica or silicate scale formation in an aqueous heat transfer water system with silica contributed by source water that includes the steps of removing hardness ions from the source water, controlling the conductivity of the aqueous system water, elevating and maintaining the pH of the aqueous system water and providing a

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metallic heat transfer surface and contacting the aqueous system water cyclically thereabout. In this regard, it should be particularly noted that the claimed methods positively recite providing a metallic heat transfer surface. Moreover, such method positively recites continuously contacting the aqueous system water with the heat transfer surface.

Neither the Boyce nor Takahashi references teach or suggest the invention as claimed. The Boyce patent, reference column 9, line 25 through column 11 line 59, teaches application of a silica scale control method used in an ion removal process which removes toxic and other ions discharged from the cooling system. It does not teach application in or treatment of a cooling system or inhibition of silica scale on heat transfer surfaces in a cooling system. Rather, the silica scale inhibition method disclosed is applied to prevention of scale or fouling of the reverse osmosis membrane system used in the waste treatment process to remove such ions before discharge or potential reuse of the water.

The Boyce patent likewise does not teach silica scale inhibition as a means of conserving water through elimination of discharge (wastage) from the cooling system or as a means of elimination of discharge of toxic chemicals from the cooling system. In the example provided, the TDS residual of the waste stream (503-716 TDS mg/l, equivalent to 670-955 umhos conductivity) to which the silica scale control method is applied in the reverse osmosis (RO) treatment process for water discharged (wasted) from a cooling system, is outside the specified ranges of the preferred embodiments of the present invention.

Moreover, the pH adjustment described in Boyce that utilizes caustic (sodium hydroxide) to increase solubility of silica in the absence of divalent metal ions removed by ion exchange would be applicable to protect the reverse osmosis membrane from silica scale, but would not be applicable to treatment of cooling systems and heat transfer surfaces. Without concurrent compensation for the highly corrosive conditions that would result from use of such water quality in a cooling water system with an effective corrosion inhibition method (heretofore not taught in prior art), prior art would have prohibited such application at the control parameters of the methods as claimed.

The deficiencies of Boyce are no way cured by the Takahashi reference. The Takahashi patent describes a process for "control" of blowdown wastage from and chemical

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addition to a cooling tower system based on measurement of conductivity in the system wastage. This method purposefully wastes cooling water to reduce concentration of scale forming ions in the water system to avert and control scale formation. The relevant concentration of scale forming ions and their resultant solubility limits can be established based on the ratio of such ions to conductivity in the make-up source water fed to the system, and can thus be "controlled" indirectly by conductivity based wastage. The conductivity based wastage control function can concurrently be used to feed chemicals such as inhibitors or biocides to replace those residual concentrations lost with the wastage of water from the system. Relative to the methods claimed herein, such method of scale control is done at the expense of water conservation and further discharges toxic treatment chemicals used to treat the cooling water with wastage from the system. The present invention eliminates these harmful practices.

In this regard, the claims of the present invention are based on "control" of conductivity or "ionic strength", as noted in paragraph 16 and 20 of the present patent application, as an independent control parameter of the method. It is known that the chemistry effects of ionic strength increase the solubility of the multivalent metal ions and their compounds that are the common source of scale formation in cooling systems. Paragraph 16 of the present application points out that conductivity may serve as an "indirect control" or indicator of residuals of alkalinity or silica provided from concentration of the source water or chemical addition. However, conductivity is not used to control the feed or residuals of the other independent chemical "control" parameters of the method. The method also does not use conductivity to control wastage, as the method objective is elimination of any wastage, and attainment of maximum residuals (concentrations) of silica, alkalinity and conductivity. While some source water make-up will require supplemental addition of either silica or alkalinity to attain the required residual ratios of the method, this would only be added on an infrequent batch or slug basis due to minimal loss from the system with the low water wastage of the method.

Moreover, the claims, as amended herein, recite methods that control hardness scale formation due to the combination of removal of the "majority" of scale forming (hardness)

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divalent metal ions through pre-treatment and the control of the cooling system water within the specified ranges of the ionic strength (conductivity) parameter to increase the solubility of such ions that remain in the method treated system. As should be understood, removal of all or sufficient divalent metal ions through pre-treatment methods to meet method application requirements is not efficient or cost feasible. Also, control of solubility and scale formation of such remaining concentrations of divalent metal ions would not be effective in the presence of high concentrations of the disclosed parameters of silica (greater than 200 mg/l and up to 4000 mg/l) or alkalinity (as pH 9.0-10.0) targeted with the water conservation objective of the method without the effect of ionic strength on ion solubility.

The final reference relied upon, the Oldsberg patent, at column 1, line 25 through 42, teaches application for source waters that contain sufficient natural CaCO₃ alkalinity to concentrate through evaporation and elevate the pH of the cooling system residual water. Not all source waters would naturally provide such alkalinity, and as noted in the patent application, caustic or other alkalinity agent may need to be added to the system water to achieve the specified method pH control parameter ranges. As such, the teachings of Oldsberg, et al., are believed to address the shortcomings of the Boyce and Takahashi reference.

Along these lines, reliance on the Boyce patent does not follow this logic as the resultant chemistry of the treated waste discharge from the cooling system would not provide sufficient or suitable alkalinity to elevate the pH to the specified control range through concentration from evaporation. The ion exchange and RO ion removal process would appreciably remove the alkalinity ions required to elevate the pH of system water through evaporation. The caustic used to increase pH and silica solubility on the removal side of the RO membrane would also be removed from the recovered water (becomes reject, and must be wasted or disposed with other ions removed, in contrast to the water conservation afforded by the present invention). Addition of alkalinity agents or use of supplemental source water containing alkalinity would be required to achieve the method preferred embodiment pH control parameters specified. Silica would also be removed by the ion removal process, and

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require supplemental silica feed or supplemental feed of silica containing source water to the system water for the method of the present invention.

Further, the methodology of the present invention differs from prior art and expectations of those skilled in the art wherein at specified control parameters, over-saturated residuals of silica (concentrated from the source water by evaporation and elimination of blowdown wastage) are preferentially precipitated in non-scale forming and non-adherent forms. This unexpected discovery is provided by method control of over-saturated silica in soluble monomeric and multimeric forms, and reduced precipitation of silica forms by multivalent metal ions and their sparingly soluble salts. Such multivalent ions and their salts accumulate in the aqueous system through concentration of incrementally introduced pre-treatment leakage and natural sources introduced into the system (i.e., scrubbed from air by the cooling tower). However, method control of electrolytic strength increases the solubility of such multivalent metal ions and their sparingly soluble salts significantly, thereby reducing associated precipitation and adsorption of silica.

The method invention differs from prior art by controlling silica / silicates where they can contribute to an extensively more effective corrosion inhibition function by: (1) control of the aqueous chemistry environment required in heat transfer cooling water for conversion of monomeric silica to multimeric silicate forms; and (2) stabilizing and maintaining significantly higher concentrations of such multimeric silicate inhibitor forms (unstable with prior art controls and consumed by precipitation and adsorption with the salts of multivalent metal ions). The noted stability and higher concentrations of stable multimeric silicate forms is also provided when addition of silicate to method systems is required if insufficient silica is present in the source water.

It would not have been obvious to those skilled in the art of cooling water system treatment, namely, metal heat transfer surface cooling, that attainment and control at such method pH and conductivity control parameter ranges, either through evaporation or chemical addition, was required or beneficial (to concurrently increase the solubility of silica to prevent silica scale formation, and to provide conversion of monomeric silica forms to the

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multimeric form for corrosion inhibition). It was known through both prior art references and those skilled in the art that application at such control parameter ranges was prohibited.

As should be appreciated based on the foregoing, the claims herein are novel and non-obvious over all of the cited references, whether taken alone or in combination. In this regard, the amended and newly added claims submitted herein include limitations that are clearly missing in the prior art. As is well-known, to establish *prima facie* obviousness of a claimed invention, all the claimed limitations must be taught or suggested by the prior art. MPEP § 2143.03; In re Royka, 940 F2d 981, 180 USPQ 580 (CCPA 1974). Specifically, the prior art has not taught operation at the range or combination of the control parameters nor the application and treatment of cooling water systems that protect heat transfer surfaces from silica scale at exceptionally high concentrations of source water ions. Neither has such prior art taught operation at such ranges of chemistry for purposes of conservation of water and elimination of discharge of toxic chemicals.

As is well-known, a *prima facie* case of obviousness is rebutted by showing that the art, in this case the Boyce and Takahashi references, teaches away from the claimed invention. MPEP § 2144.05; In re Geisler, 116 F3d 1465, 1471, 43 USPQ 2d 1362, 1366 (Fed. Cir. 1997). Moreover, even assuming these references provide some type of general guidance to treat the water by elevating pH and controlling conductivity, and thereafter cycle the usage of such treated water such general inference is not sufficient to support the burden of establishing a *prima facie* case of obviousness.

Additionally, in rejecting claims under 35 U.S.C. § 103, the Examiner bears the initial burden of presenting a *prima facie* case of obviousness. In re Oetiker, 977 F.2d 1443, 1445 (Fed. Cir. 1992). To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in prior art references or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art,

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not in Applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991), M.P.E.P. § 2143. Such standard is true even for simple changes or combinations. See, In re Chu, 66 F.3d 292, 36 USPQ2d 1089 (Fed. Cir. 1995), citing In re Gordon, 733 F.2d 900, 902, 221 USPQ2d 1125, 1227 (Fed. Cir. 1984)). In this case, there is simply no appreciation in either Boyce or Takahashi to derive the present invention, especially given its tremendous advantages to reduce wastewater and release of chemical agents into the environment.

Based on the foregoing, Applicant respectfully submits that, as amended herein, all of the claims are allowable and requests early notice to that effect. Applicants and their counsel would again like to thank the Examiner for his consideration in this matter and to request that the Examiner contact Applicant's counsel should the Examiner have any questions, require additional information, or have any suggestions to resolve any outstanding issues that may exist.

If any additional fee is required, please charge Deposit Account Number 19-4330.

Respectfully submitted,

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